

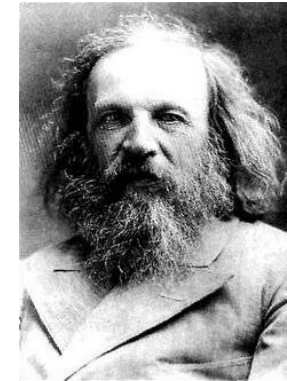
Nuclide Charts and the Nuclide Explorer

Wenesday, 22nd Oct. 2009

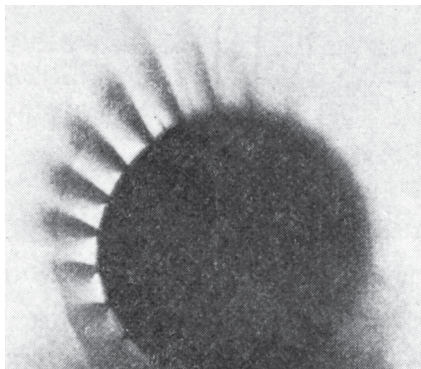
Christophe Normand
European Commission
Institute for Transuranium Elements
Postfach 2340, 76125 Karlsruhe, Germany
E-mail: christophe.normand@ec.europa.eu

<http://www.nucleonica.net>
<http://www.karlsruhenuclidechart.net>

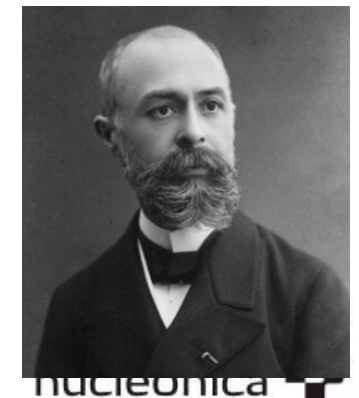
1																										18	
1 H		2														13					14	15	16	17	2 He		
3 Li		4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne									
11 Na		12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar									
19 K		20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr									
37 Rb		38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe									
55 Cs		56 Ba	57-71 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn									
87 Fr		88 Ra	89-103 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112	113	114	115	116	(117)	118									
(119)		(120)	(121-153)	(154)	(155)	(156)	(157)	(158)	(159)	(160)	(161)	(162)	(163)	(164)	(165)	(166)	(167)	(168)									
Lanthanides			57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu										
			89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr										
			(121)	(122)	(123)	(124)														(153)							
Super-Actinides																											



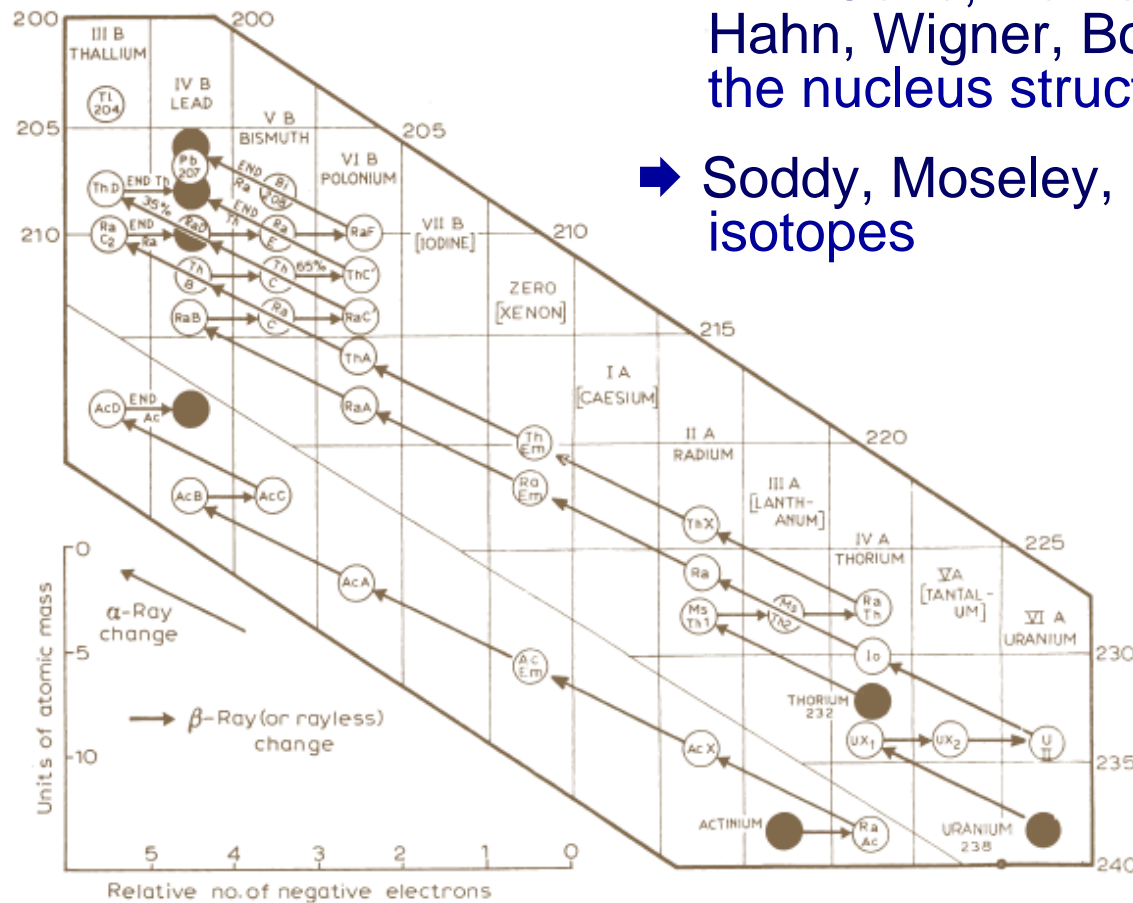
➡ Mendeleyev table 1869,
Chemical properties, Mass
Number



➡ H.Becquerel 1896, discovery of radioactivity



- ➔ With Curie, Rutherford, Fermi, Hahn, Wigner, Bohr, knowledge of the nucleus structure
- ➔ Soddy, Moseley, De Hevesy, isotopes



F. Soddy



H. Moseley

Radio-elements and Periodic Law. The neutron was not discovered yet.





G.T. Seaborg, 1951



W. Seelmann-Eggebert
“El profesor alemán”

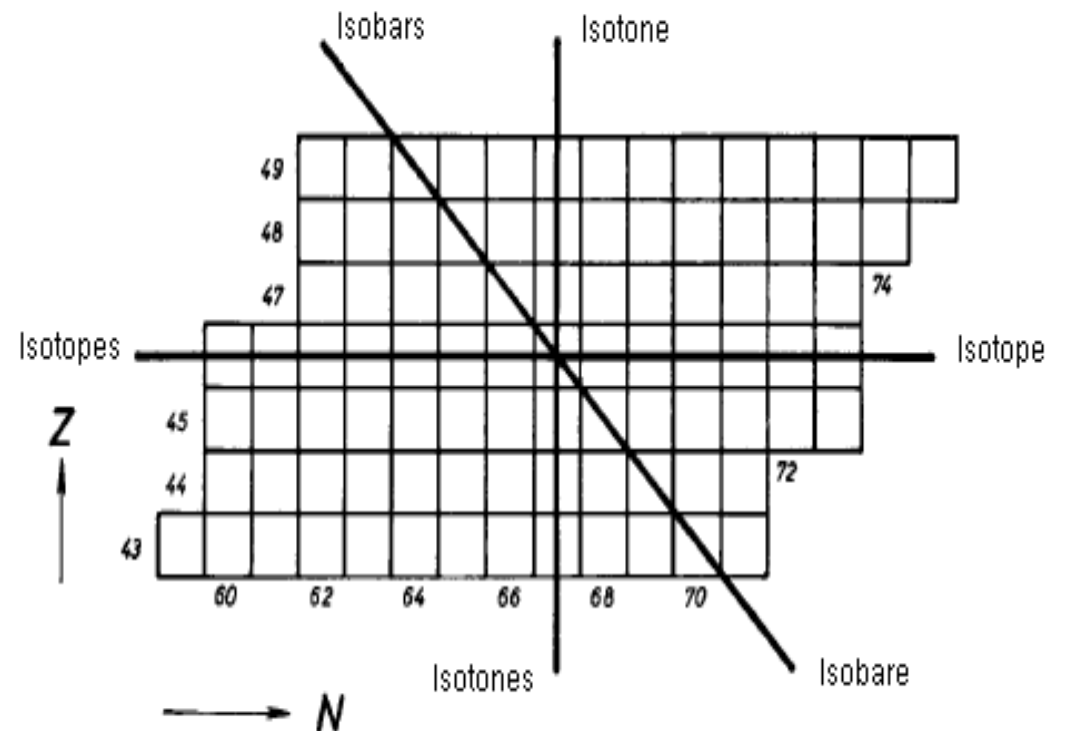
- ➔ Representation of nuclides in a proton/neutron map system (Fea 1935, Seaborg, 1940, Segrè 1945)
- ➔ 1958 first edition of the “Karlsruher Nuklidkarte” W. Seelmann-Eggebert and G. Pfennig from the Karlsruhe Radiochemical Institute.
- ➔ 267 stable and 1030 radionuclides for 4 decay modes

Nuclide : *A type of atom specified by its atomic number, Z , mass number, A , and energy state.*

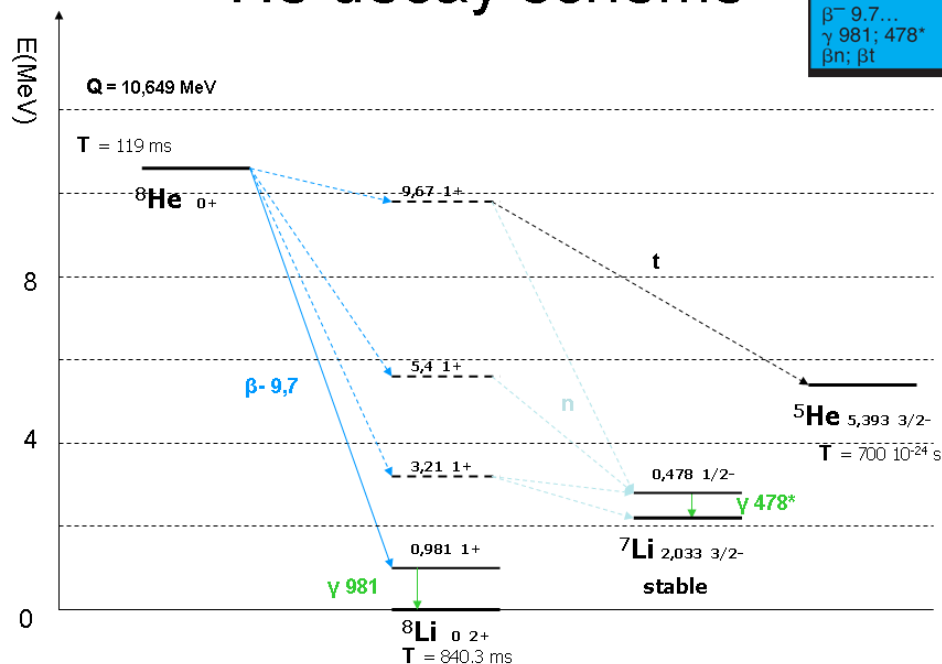
Isotopes : *meaning at the same place in the periodic table ➡ nuclides with same Z .*

Isotones : *nuclides with the same $N (=A-Z)$.*

Isobars : *nuclides with the same A .*

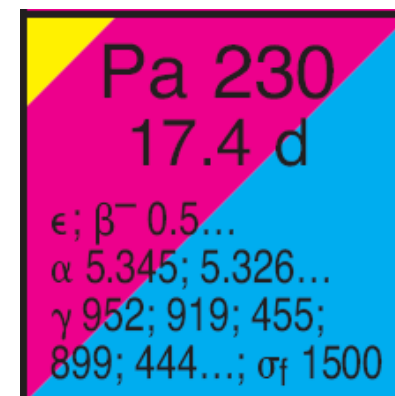


^8He decay scheme

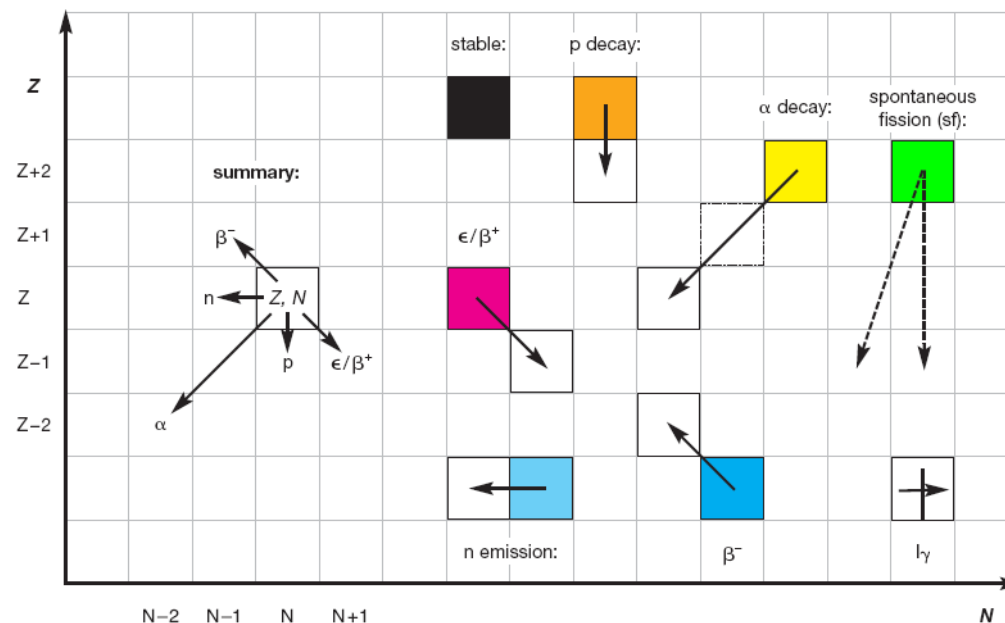


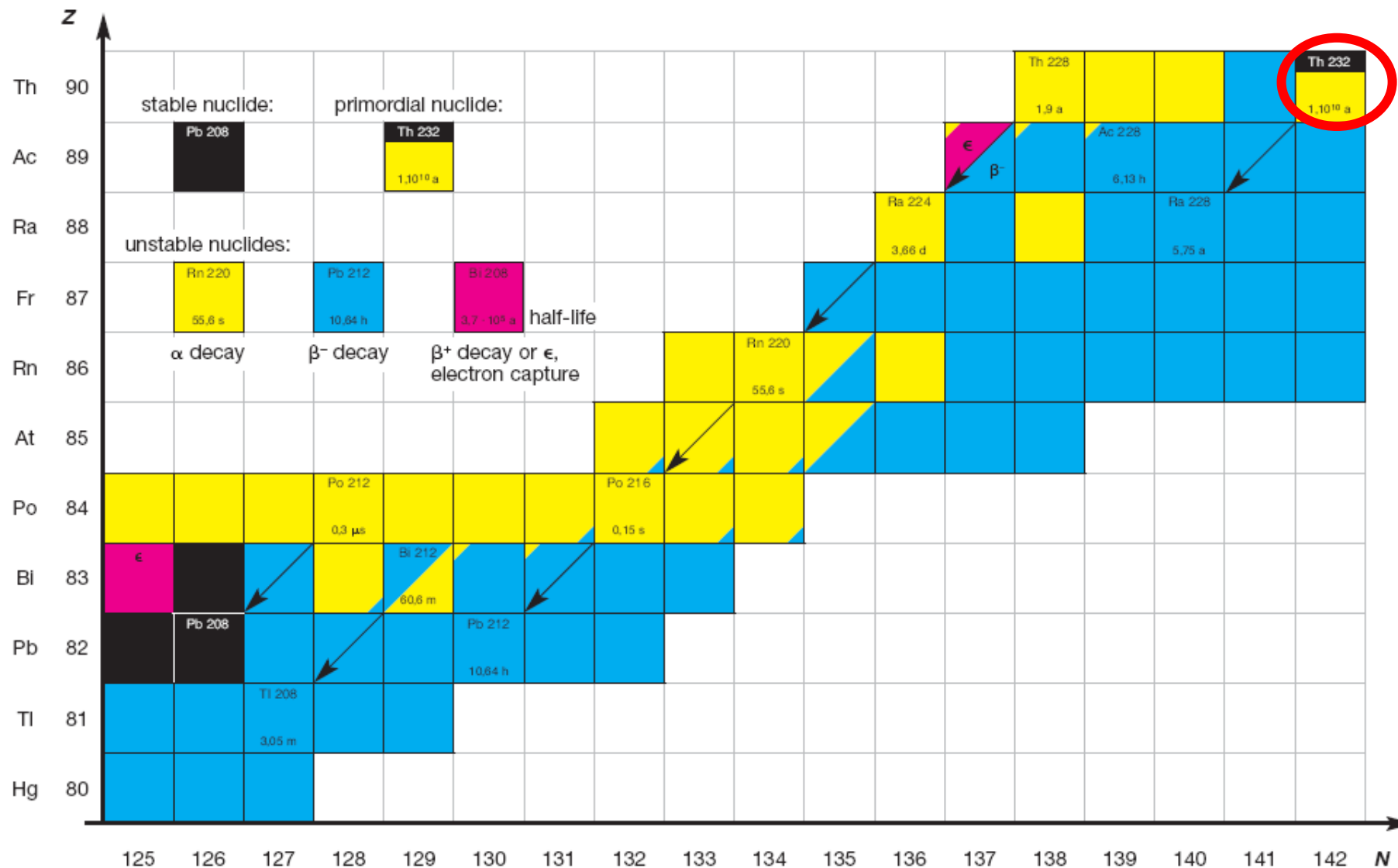
He 8
119 ms
 β^- 9.7...
 γ 981; 478*
 βn ; βt

Branching ratios \longleftrightarrow Coloured areas

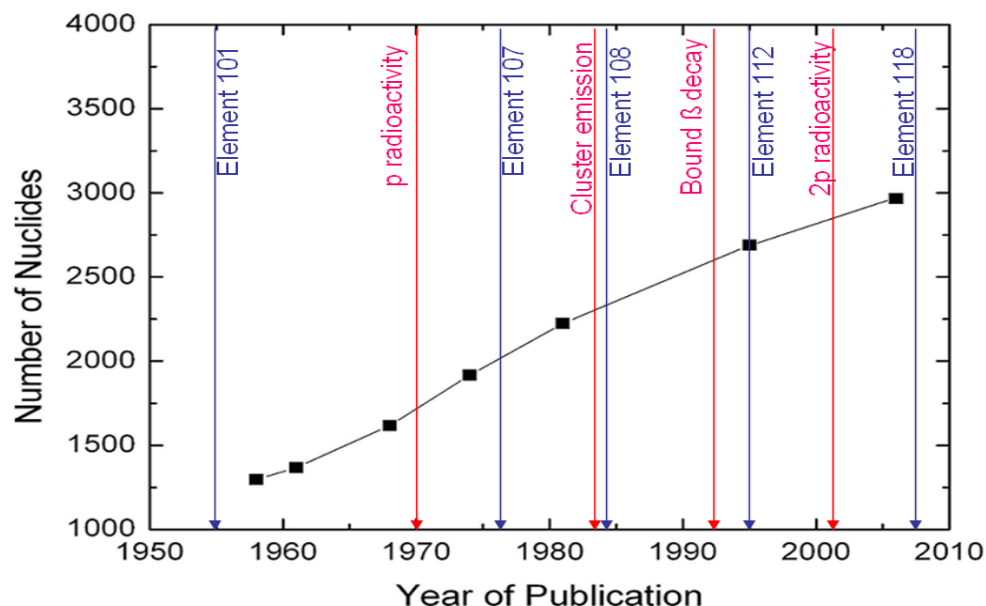


Colours \longleftrightarrow Decay Modes



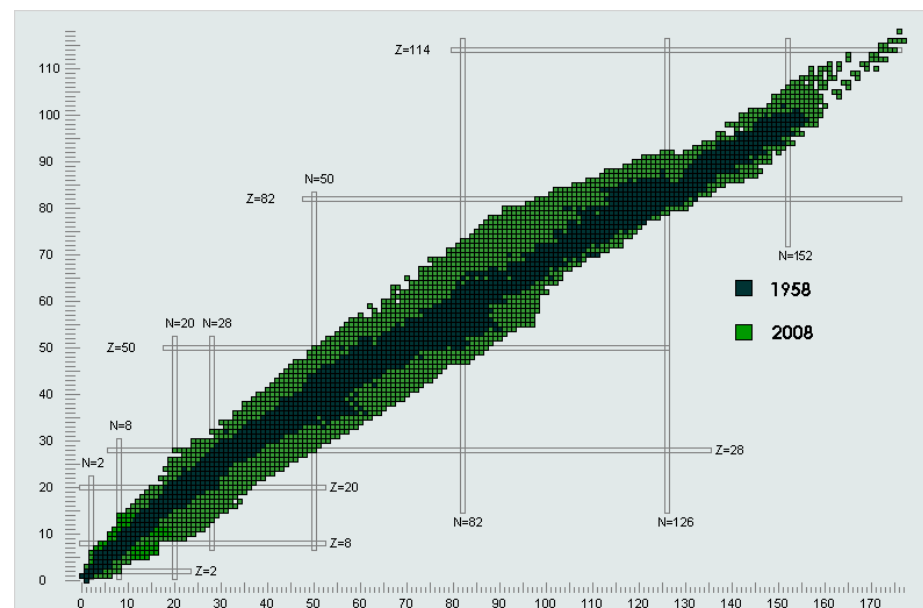


Number of Nuclides for the 7th edition: 2962 ground states and 692 isomers Progress in nuclear structure knowledge



- ➔ Between the first edition and the 7th edition the number of nuclides has increased from 1300 to 3000. Theoretical predictions are expecting 6000 possible ground-state nuclides

Number of Nuclides in the KN editions



2p radioactivity:

Short-life nuclides: ${}^6\text{Be}$, ${}^8\text{C}$, ${}^{12}\text{O}$, ${}^{16}\text{Ne}$, ...

Excited States (Isomers): ${}^{94m_2}\text{Ag}$, ...

Pure 2p radioactivity: ${}^{45}\text{Fe}$, ${}^{48}\text{Ni}$, ${}^{54}\text{Zn}$, ...

Direct observation of 2p in ${}^{45}\text{Fe}$:

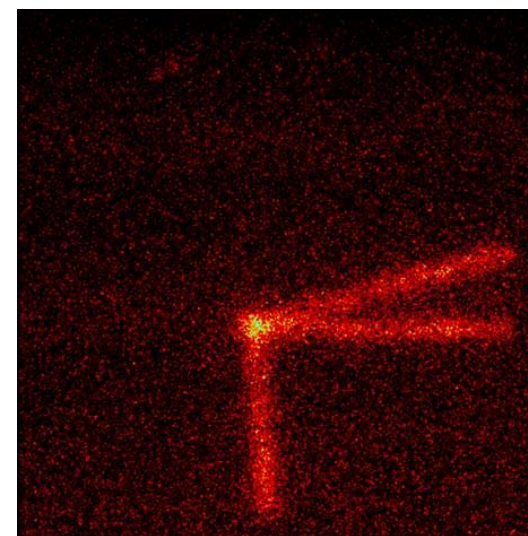
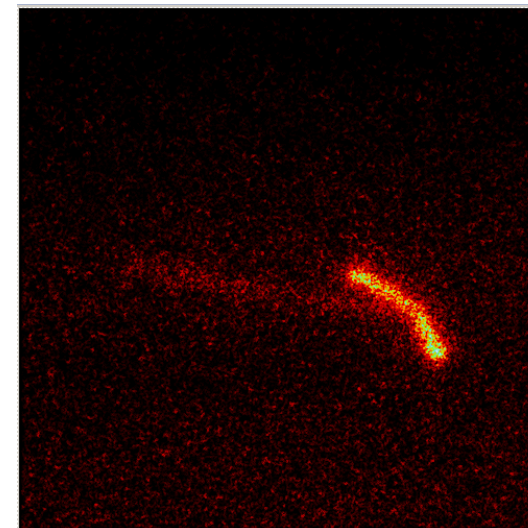
M. Pfützner, et al., *Eur. Phys. J. A* 14, 279 (2002).

J. Giovinazzo, et al., *Phys. Rev. Lett.* 89, 102501 (2002).

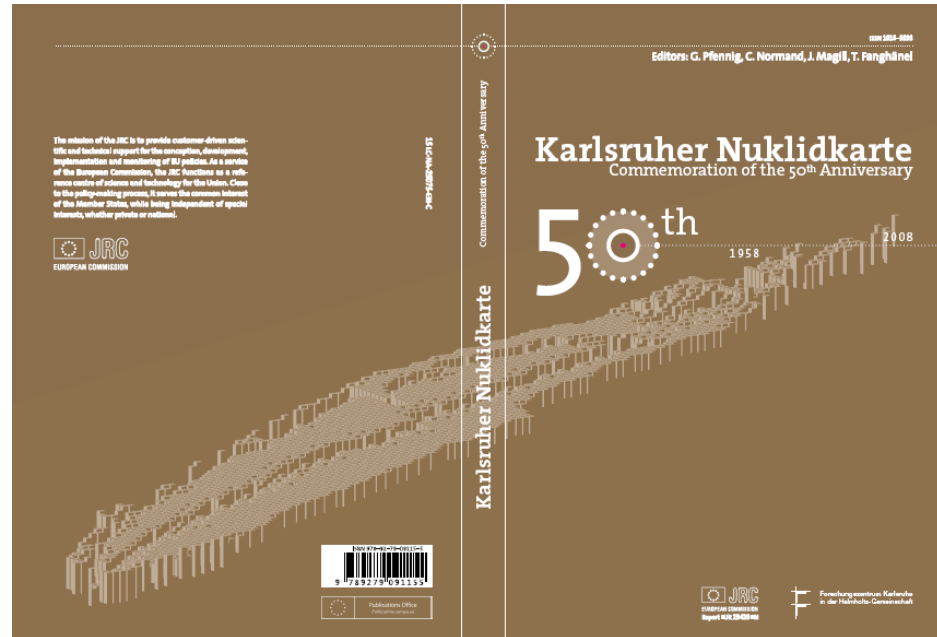
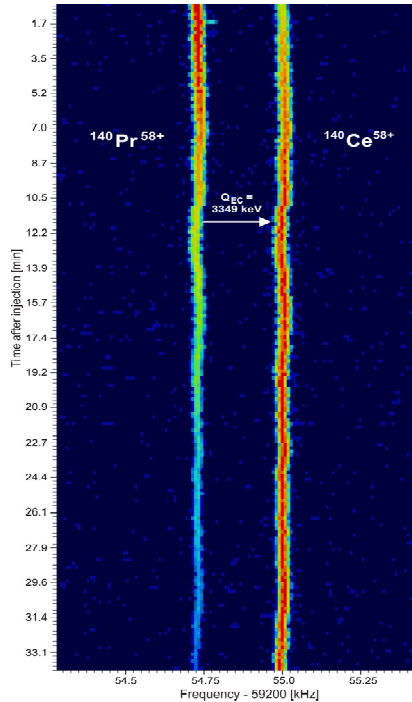


Additional βnp modes

K. Miernik, et al., *Phys. Rev. C* 76, 041304 (2007)

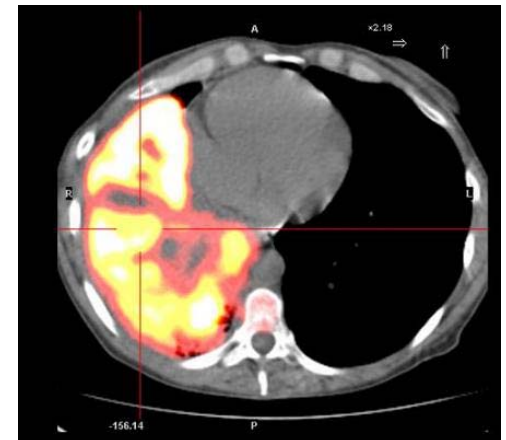
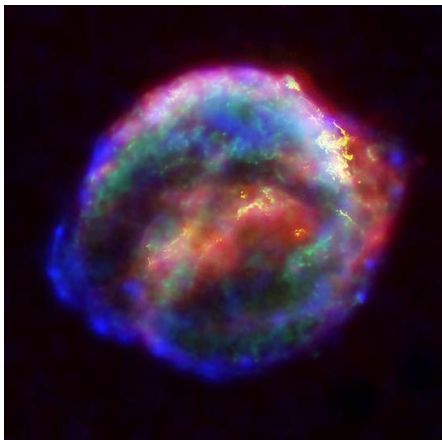



Images courtesy of M. Pfützner .



50 years of mapping the nuclear landscape

- ⇒ **History**
- ⇒ **Experimental developments**
- ⇒ **Quarks and nuclei**
- ⇒ **Beta decay and neutrinos**
- ⇒ **Elements and nuclides**
- ⇒ **Nuclear Data**
- ⇒ **Applications**

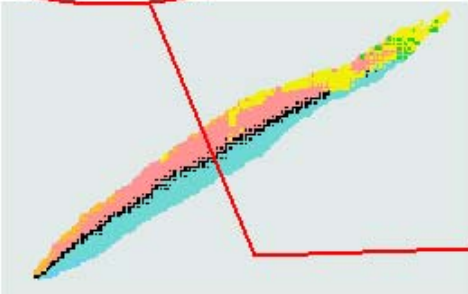




... web driven nuclear science

[Applications](#)
[My Preferences](#)
[Help](#)
[New Alerts](#)

Nuclide Explorer



>> Actual Chart: Karlsruhe


Application Centre


- >> Mass Activity Calculator
- >> Decay Engine
- >> Dosimetry & Shielding
- >> Range & Stopping Power
- >> webKORIGEN
- >> **Universal Nuclide Chart**
- >> Transport & Packaging
- >> Nuclide mixtures
- >> Nucleonica Scripting
- >> Library creation for 3rd party software
- >> Extended Graph Module

Data Centre

- >> Physical Constants
- >> Nuclide Datasheets
- >> Nuclide Derived Data
- >> Average Cross Sections
- >> Radiations
- >> Prompt Gamma
- >> Fission Yields

Search Nucleonica Documentation

 Nuclear Data Retrieval



Welcome, Christophe

[Edit Preferences](#)
[MyCommunity Portal](#)

My Last Nuclides

- 49 In107
- 2 He6
- 45 Rh91
- 28 Ni56
- 82 Pb200

My Nuclide Mixtures

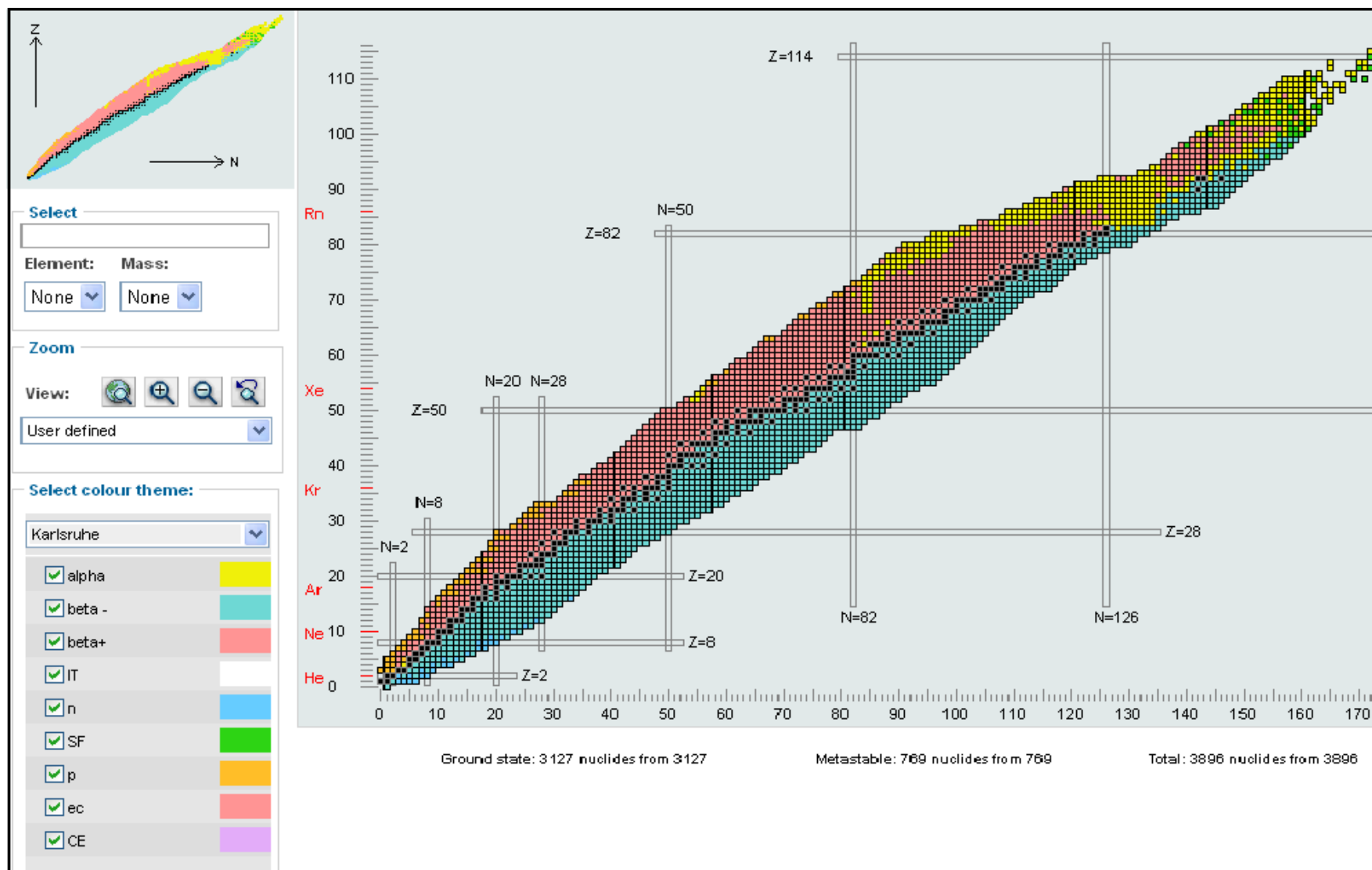
- AAA
- AAA Decay Engine Result

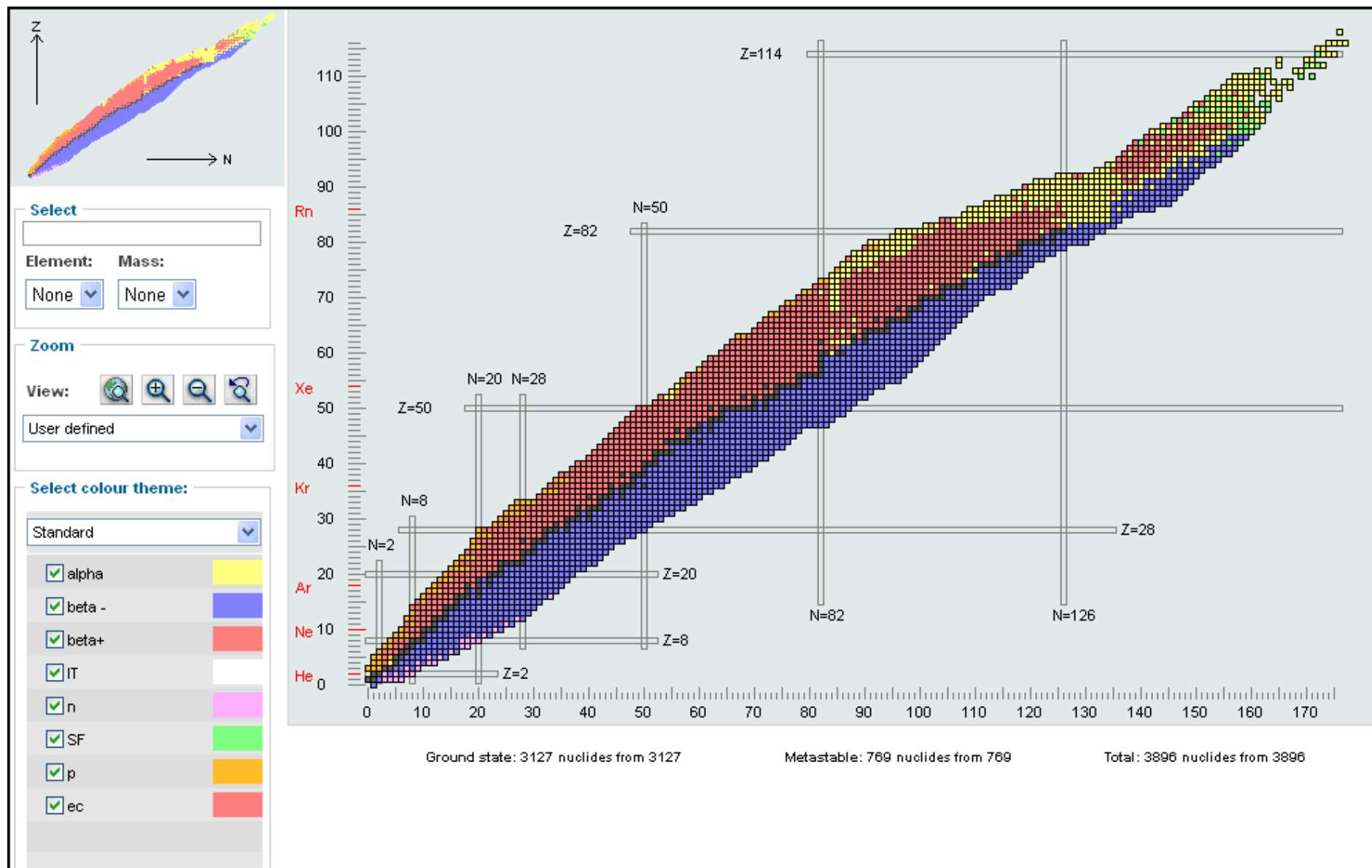
My Sources

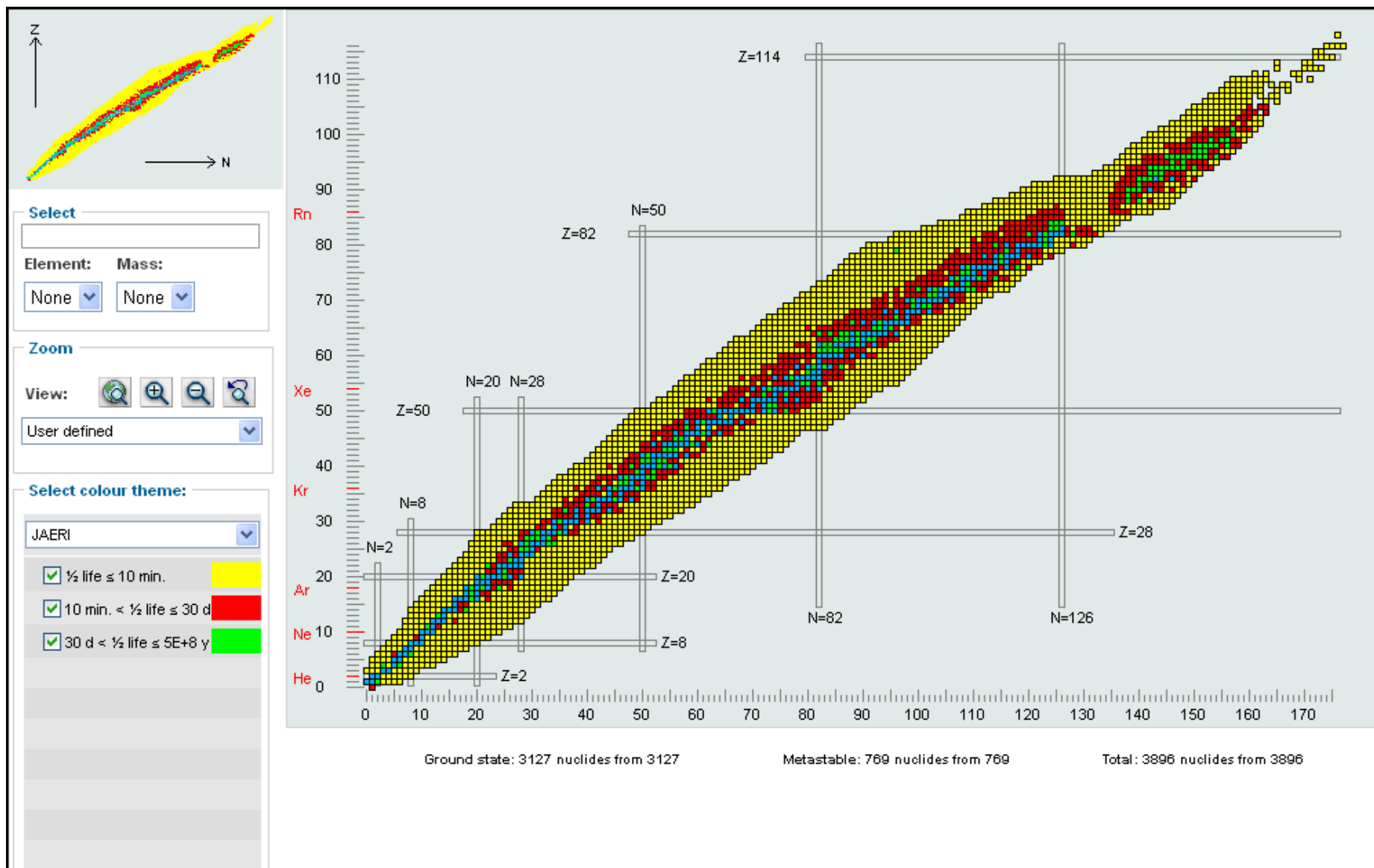
- goto

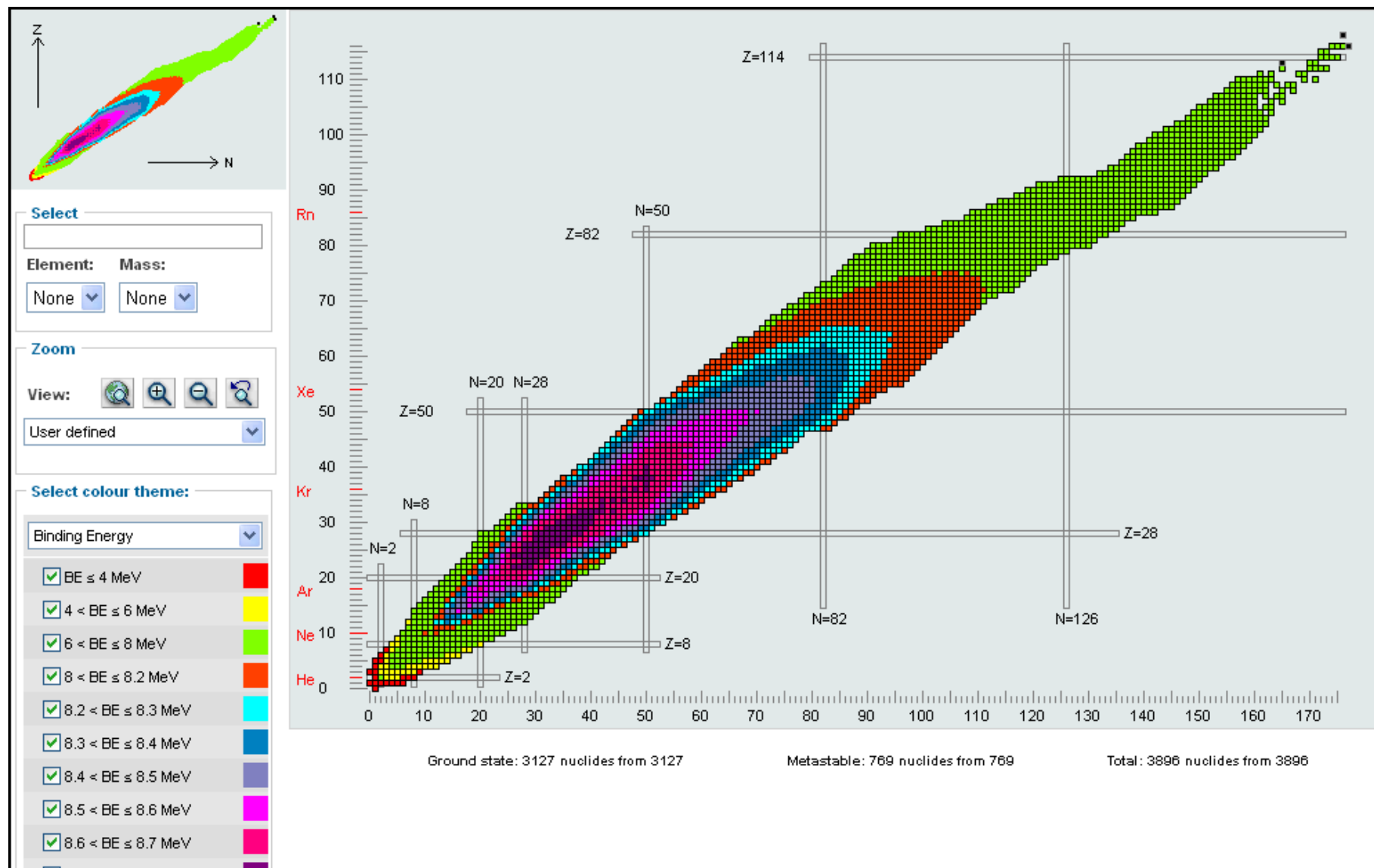
My Messages

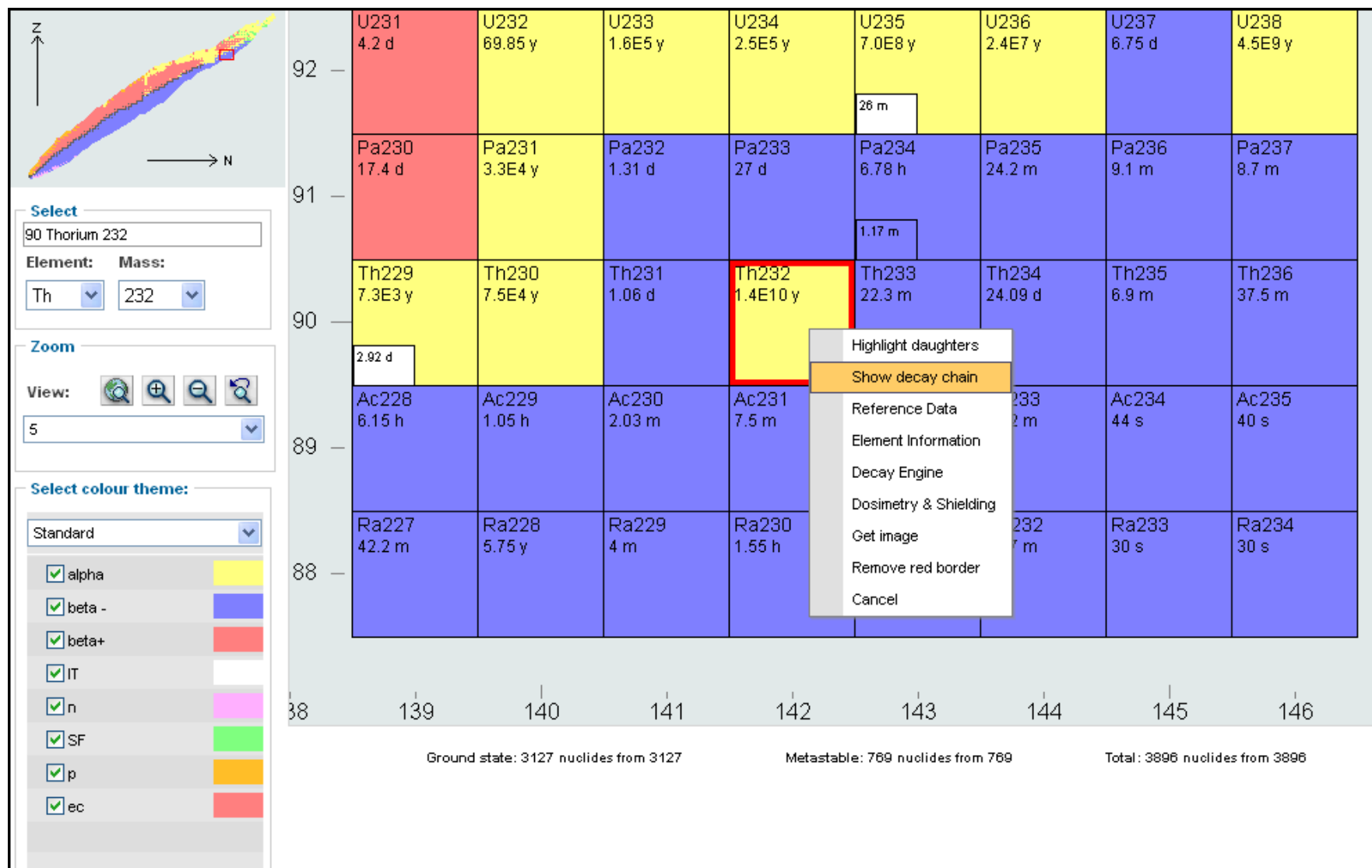
- NAMLS-9 International Conference on Nuclear Analytical Methods in the Life Sciences
- Open positions at the University of Liège
- NEVI The next Nucleonica training course 25/26 October 2007, Karlsruhe

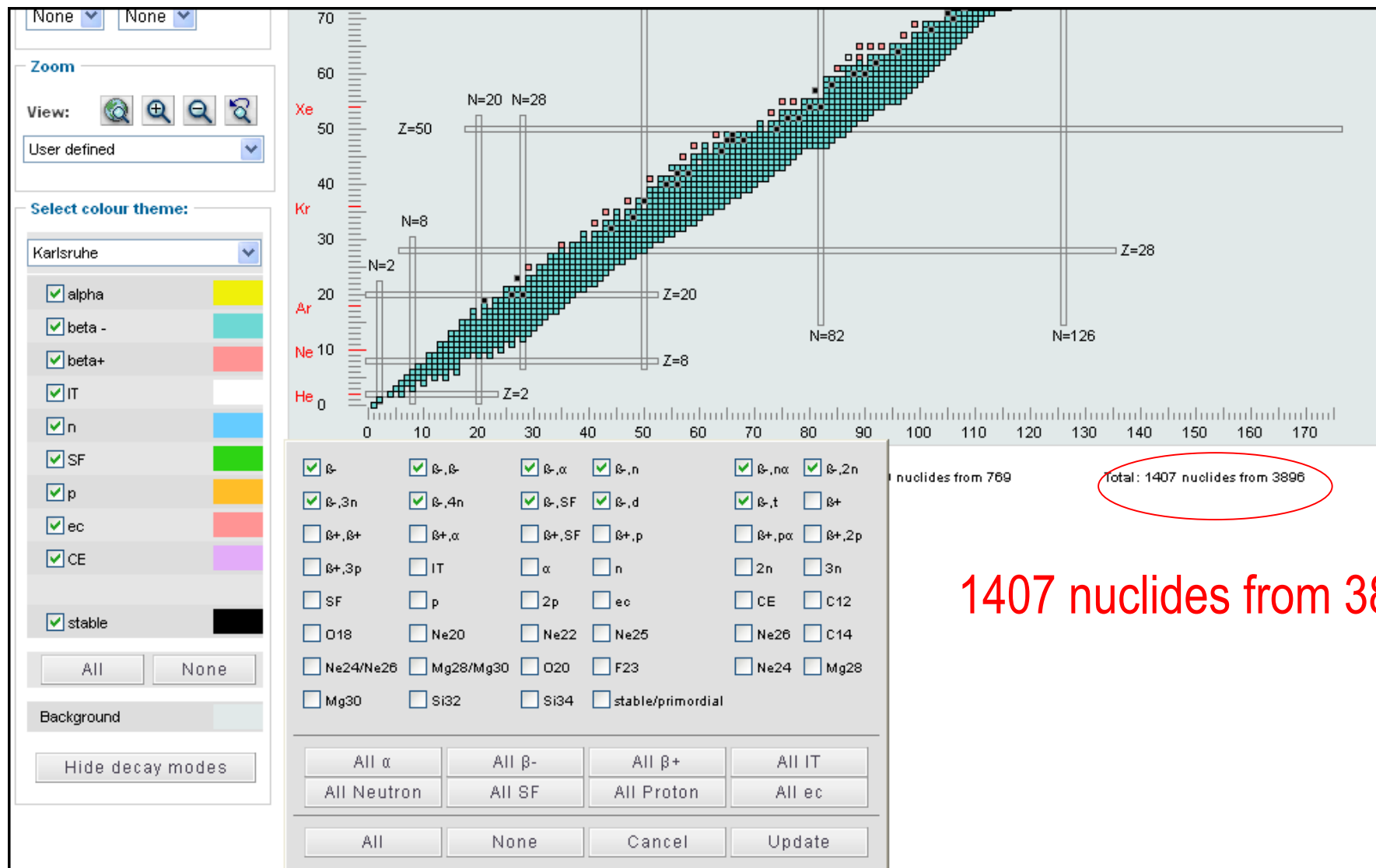




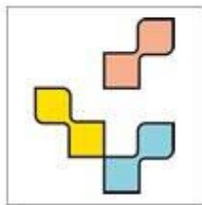




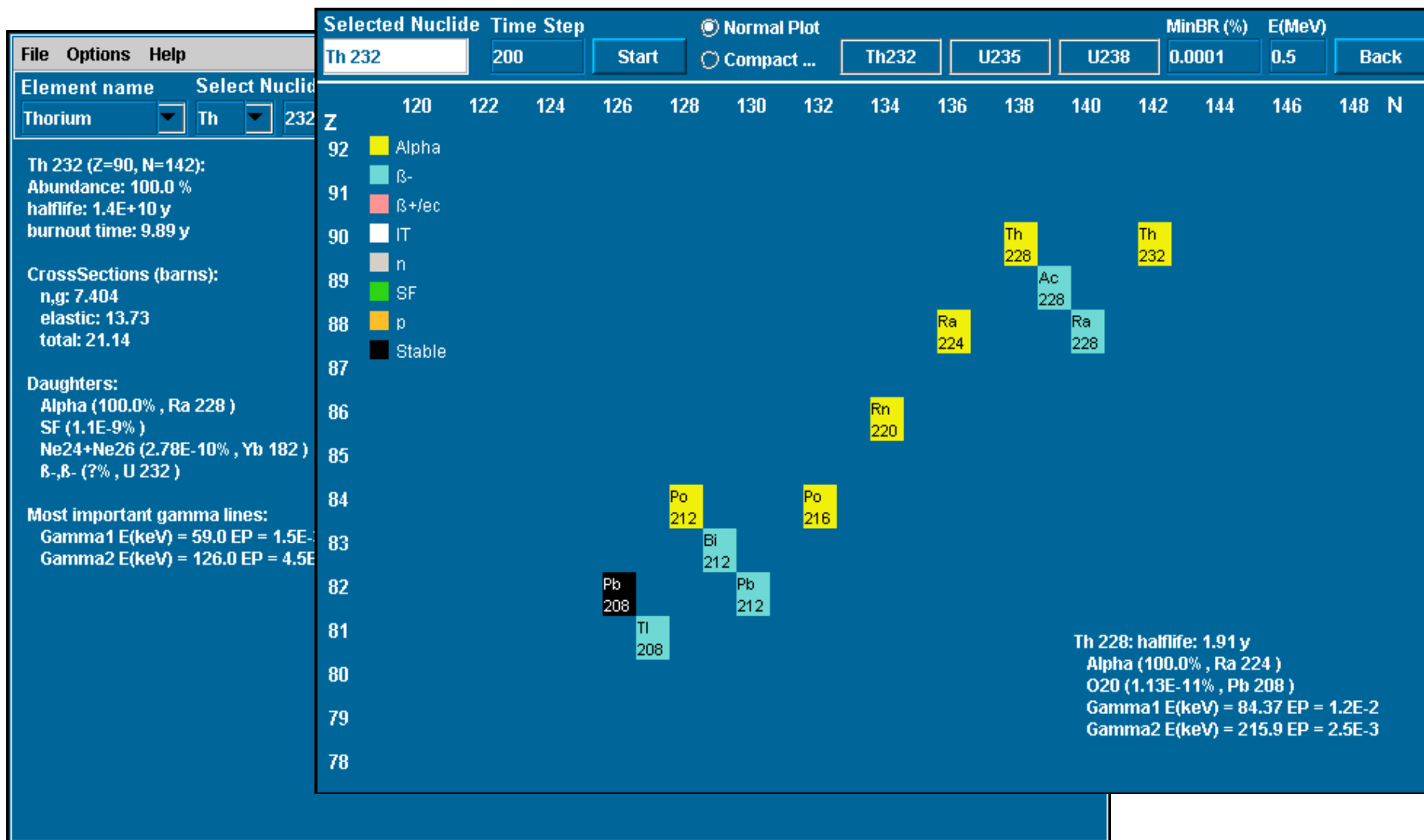




1407 nuclides from 3896



Universal Nuclide Chart



Nuclide Charts

*An important tool for
nuclear scientists*

*Choice of the database & of
the physics/colour
scheme*

*Huge advantage of
Nucleonica giving access
to all related information*

More information at

www.karlsruhenuclidechart.net

Nucleonica Wiki Webpage

Translations

help discussion edit history move watch

Help:Karlsruhe Nuclide Chart

Contents [hide]

- 1 Introduction
- 2 Online Shop
- 3 Press Releases

Explanation of the Nuclide Chart

For further information on the Karlsruhe Nuclide Chart, 7th edition, we have extracted the multilingual "Explanation of the Chart of the Nuclides" from the brochure. The pdf's can be found below for download:

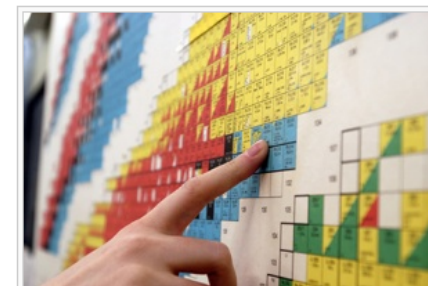
- English/German [↗](#) Explanation of the Chart of the Nuclides
Erläuterungen zur Nuklidkarte
- Spanish/French [↗](#) Explicaciones de la carta de nucleidos
Explication de la carte des nucléides
- Chinese/Russian [↗](#) 核素图解释
Пояснения к таблице нуклидов

Italian/French translated by M.R.Tedeschi [↗](#) Spiegazione della carta dei nuclidi

English/Japanese translated by Dr. K. Uozumi [↗](#) 「核種チャート」の解説

English/Korean translated by Dr. P. Lee [↗](#) 핵종(核種) 도표 설명

English/Romanian tr. by Dr. Catalin ALECU [↗](#) Explicatii privind Harta nuclizilor



Karlsruhe Nuclide Chart wallchart, 7th Edition

These documents provide a comprehensive explanation on how to use the Karlsruhe Nuclide Chart.

Additional translations? Are you interested in translating the "Explanation of the Chart of the Nuclides" into your own language? If so, please contact: Joseph Magill (joseph.magill@ec.europa.eu)

Thanks!

nucleonica

